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To ascertain the degree to which educational media was being utilized in vocational-technical training, a study was conducted involving a review of related literature and a reporting of four instructional approaches. Examination of literature yielded some generalizable findings: (1) Teaching of manipulation activity fy film, television, and programmed instruction was reported to be effective. (2) The learning of a certain task requires different types of observation and participation by the learner. (3) There were no significant differences among most treatment comparisons. (4) Learning tasks place effectively under various kinds of instruction, and (5) Industry has found programmed instruction to be at least as effective as other methods of instruction and has also found that it results in less instructional time. Some conclusions were: (1) Programmed instruction cuts training time 20-30 percent. (2) Individuals from all abilities and age levels can learn effectively from properly prepared programmed materials. (3) The amount and type of educational media in vocational-technical education is limited, and (4) Little effort has been made to integrate educational media into the teaching of manipulative skills. (DM)

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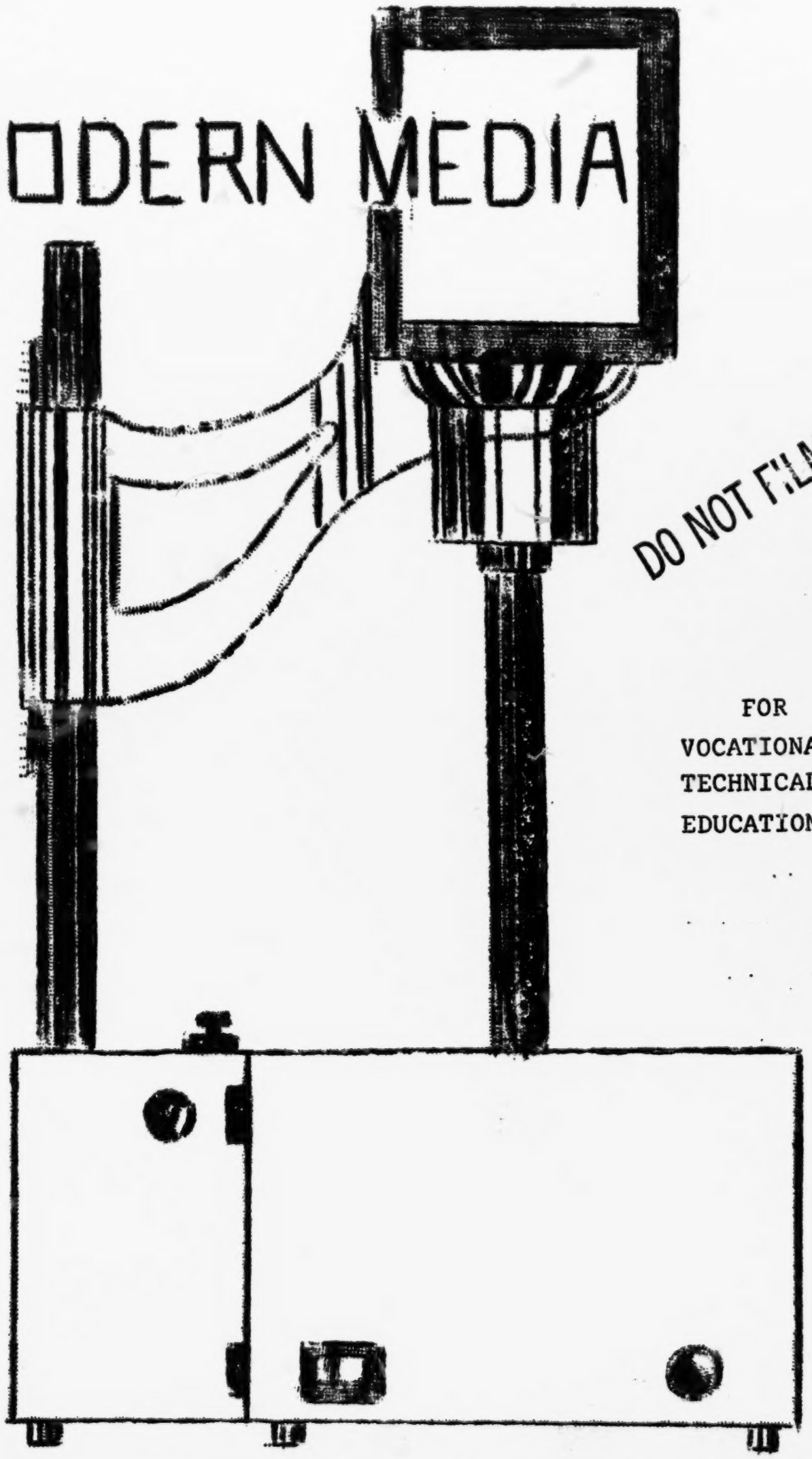

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REVIEW OF RELATED LITERATURE

The following study was designed to ascertain to what degree educational media was being utilized in vocational-technical training across the country. Special emphasis was given to the machine trades and related areas. A survey of the related literature disclosed a dearth of material in this area, but it did reveal an increasing amount of programmed material being developed for trade and industrial subjects and their related areas.

Programmed Learning

Stolurow (1961) in "Teaching by Machines" surveyed the literature on auto-instruction, but did not list any experiments being conducted in the machine trades and related areas. However, he did list a number of studies conducted in the military utilizing programmed materials to train technicians in equipment operation and maintenance. Of equal interest was a parallel study by the Institute for Communication Research (1960) on "New Teaching Aids for the American Classroom". However, this study also revealed no evidence of programmed instruction in the area of the machine trades and related areas. These surveys described the need for, and the utilization of, all types of devices in the teaching of various kinds of subject matter. But, by and large, most of the work in the area applies to sporadic experiments conducted individually in various locations and settings. Increasingly, however, more attention has been paid to this dimension of learning with more experimentation being conducted each year.

Self-instruction is not a current innovation in our schools, for it has probably been taking place in one form or another in classrooms since ancient times. In America a good starting date would perhaps be 1888 when Preston W. Search developed a systematic plan of instruction for treating individual differences in the secondary school. (1950)

The chief pioneering efforts in this dimension really forged ahead in the early 20th century when Frederic Burk began to break the academic lockstep by developing individual instructional materials. His work ultimately crystallized into the Winnetka Plan outlined by a member of his faculty, Carleton Washburne. In essence the Winnetka system was, as the title of his book suggests, "Adjusting the School to the Child." However, the real adaptation of the school to the individual meant more than merely allowing each child to progress at his own natural pace. It meant developing the child's originality, initiative, and creative impulses. The main features included an outlined curriculum of common essentials on the one hand, and group and creative activities on the other. In addition, provision was made for a wide variety of socialized group work and creative activities. (1932)

A comparable plan known as the "laboratory method" was developed by Helen Parkhurst and adopted by the high school in Dalton, Massachusetts in 1920 on an experimental school-wide basis. In an introduction to Parkhurst;s book entitled, "Education on the Dalton Plan," T.P. Nunn said, "Miss Parkhurst has envisaged a definite problem of great practical importance; mainly, how to secure from the vast volume of educational effort expended in school a richer harvest of individual culture and efficiency." (1922)

The Dalton Plan, like the Winnetka Plan, emphasized individual work. In its full operation it meant reorganization of subjects and classes while providing a social reorganization in consequence. The Plan was punctuated by the three fundamental principles:

1. Freedom of the individual to work with no fixed daily schedule.
2. Individual work with differentiating assignments for different ability levels.
3. Interaction in the group.

In essence, the Winnetka and Dalton Plans were comprehensive attempts to provide a high degree of individualized instruction by accommodating variations in rate of progress, as well as in degree.

Since World War II, and especially since "Sputnik", a great new emphasis has been placed on individual differences. A variety of programs have evolved which place more responsibility on the student for his own learning. Particular emphasis has been placed on the advantages resulting from learning through self-paced instruction.

In 1962, twenty-seven research projects dealing with auto-instruction materials and techniques were supported by the New Educational Media Program. Federal funds totalling approximately 1.87 million have been obligated to bring these research projects to completion. (1961)

Since government and industry are exploring the concept of programmed instruction, it seemed wise to describe a related set of studies which reported the utilization of this approach in teaching the maintenance and operation of various kinds of equipment. In the following reported investigations, military trainees were taught technical information and skills.

Briggs and Bernard (1956) reported a study in which a Subject-Matter Trainer was used to provide immediate knowledge of results to Air Force Trainees in a maintenance course. The Subject-Matter Trainer was used for fifty-eight out of a total of one hundred and fourteen hours of instruction with the experimental group, and for fourteen hours with the control group. Reinforced practices were given the experimental group in learning facts and principles, and in preliminary rehearsal of maintenance procedures.

The results indicated that on individual performance tests, the experimental group scored higher than the control group. The groups did not differ significantly on the written test. The reinforced

practice did not improve written test scores, but provided an increment on the performance test.

In a second related study, Cantor and Brown (1956) investigated the influence of various training methods in teaching electronics trouble-shooting to Navy trainees. Three groups participated in the study. One group of trainees used the Trainer-Tester, a device comprised of a large sheet with silver overlay printed on top of the answers to trouble-shooting problems. A second group used a Pressey-type punch board, and a third group used the traditional Navy method of electronic instruction involving large mockups of equipment.

The results of the study showed that the Trainer-Tester and Punchboard groups were superior to the "equipment only group." However, the "equipment only group" was superior in equipment usage. Examination and laboratory grades favored the Trainer-Tester and Punchboard groups.

It appears that programmed materials can be used effectively for the teaching of verbal manipulative skills with particular success at the application level.

Mayer and Westfield (1958) utilized the Subject-Matter Trainer to train Air Force maintenance personnel. They investigated an on-the-job proficiency device. One group was comprised of interceptor directors and track monitors trained for operator efficiency on a Semi-Automatic Ground Environment System. A second group studied by means of a workbook in which knowledge of results was made available by having answers to questions printed on the back of each page. Students were allowed to look ahead at the answers.

Mayer and Westfield reported that both groups made gains and that some of the gains favored the workbook group. No control group was employed and all subjects received immediate knowledge of results by different methods. In this study inexpensive materials seemed to

provide for a performance equal to that produced by expensive machine devices. These findings could be important to vocational, and technical education, when the learning of motor skills and technical information is very important.

O'Donnell (1965) reported an investigation in which industrial workers were taught by programmed instruction and conventional methods. One group was given the programmed instruction version of "Reading Engineering Drawings," while a second group was given conventional classroom training on the same subject presented by a well qualified instructor.

The results showed the programmed instruction group on the average spent 25% less time in learning the subject and achieved 13 per cent higher scores on the final examination than those who received the conventional instruction.

Eighteen months after the initial experiment both groups were retested. All groups did forget some of what they had learned, but the spread between the achievement of the two groups did not change significantly.

This study indicates that programmed instruction is an effective method for training adults in industry. It also indicates that if industry is using programmed instruction successfully then the state's vocational-technical schools should consider this method for instructional purposes.

Morse (1962) reported a study in which three groups of fourteen telephone installer-repairmen were taught job information and skills by different instructional techniques. Groups were equal in prior knowledge and experience in the job area, and in general intelligence. Two groups were taught by programmed instruction while the third group was presented the same material by the lecture-demonstration method. One programmed group used a text, while the other used a teaching machine.

Results on a criteria and a retention test (which was given six weeks after the completion of the course) showed no significant difference between groups. However, the programmed trained groups took 30% less total training time.

Hughes (1962) reported a study in which subjects were taught the first 15 hours of the IBM 7070 course. Two groups of twenty-one subjects were taught by the conventional lecture-demonstration method. The experimental group consisted of seventy subjects presented the same materials in programmed form. There were no significant differences between the control and experimental groups in age, educational level, months of previous customer-engineering or computer experience.

The results showed that the experimental group learned significantly more than the control group and that it took twenty-three per cent less time to complete this fifteen hour segment of the course.

A questionnaire given to the IBM experimental group showed that 87% preferred programmed instruction to conventional instructional methods. All the subjects in the experimental group felt programmed instruction was more effective and 93% thought it was less difficult than the conventional lecture-demonstration method of instruction.

Complaints concerned mechanics, repetition, difficulty of review, and boredom from too much programmed instruction without some type of classroom discussion.

The results of these two studies indicate that programmed instruction cuts instructional costs and time. It also allows decentralization of instruction into branch training centers.

In a second study by Hughes (1962) subjects were taught maintenance of the "083 Sorter" by programmed instruction and learned significantly more than subjects taught by the conventional

lecture-demonstration method. The results also showed that the programmed instruction group completed this segment of the course in less time.

Learning from Instructional Films

The literature clearly indicates that most of the teaching that is automated by television and most forms of instructional films are essentially classroom instruction by the lecture-demonstration method. This method is a one-way sequenced and paced presentation of information to a group of students. However, learning theory states that effective learning is not a process of sbsorption or passive reception of impressions, but a process of active striving and searching for creative construction of integrated response patterns to meet problem situations.

A number of experiments have been conducted during the past ten years that extend knowledge about active-recitation or practice-sequence during learning. Acquisition of this knowledge will enable educators and psychologists to modify the passive-reception limitations of the customary forms of films, television, and lecture presentations.

Allen (1957) reported twenty-six studies in which active student response was used in conjunction with presentation of content by means of films. Thirteen of the studies favored participation, while only two favored non-participation. The remaining eleven comparisons indicated that participation was equal in effectiveness with non-participation. The studies were summarized under headings of: Verbalization of Response, Perceptual Motor Responses, Knowledge of Results, Mental Practices, and Note-Taking. Of these five categories only Note-Taking seems to be of doubtful value.

It seems worthwhile to review three of these studies which have implications for the present investigation of how educational media is being used in vocational-technical education. The first was presented by Maccoby and Michael in 1953. The subject matter was of a substantive verbal type dealing with defense against atomic attack. Students were allowed to respond actively during predetermined intervals of the film through the device of a question and answer insertion during film exposition intervals. Written responses were utilized rather than oral responses, and feedback which followed the student's response was accomplished by announcement of the correct answer to each question rather than by pickup from an oral class chorusing.

The study was concerned with the following three aspects of Socratic review sequence: (1) motivational versus practice effects; (2) overt versus covert responding; and (3) the importance of feedback in the form of response-correction. The major role of the practice factor was demonstrated by comparing the results of the passive or no-participation group with those of the active-response groups. The results of the experiment showed that the gains from active response were attributable to specific practice effects and not to motivational benefits accruing to items not specifically practiced. The largest single factor in determining the efficiency of the active response procedure was the provision of feedback correction by giving the correct answer after students had responded to each question. Covert or subvocal responding was about as effective as overt written responding in this experiment.

Maccoby and Sheffield (1956) also manipulated conditions that affect the probability of a correct response occurring during training. The tasks to be learned were sequential procedures presented in a

film demonstration several times, with practice following each demonstration. The variation that affected probability of the correct response occuring was the length of sequence demonstrated before each practice period. Results indicated that the poorest performance, both during practice and on later tests, occurred when the entire task was demonstrated before allowing a practice period. The highest level of performance was achieved when the demonstration depicted a small segment of the total task with immediate practice; all segments of the total task were presented in this procedure.

The main conclusion from this study is that a task presented in small segments of materials and manipulative skills can be learned more rapidly than a task presented in one large segment. This is one of the features common to programmed materials utilized in teaching manipulative type skills.

Psychological concepts relevant to the rate and size of instructional procedures were reviewed by Carpenter (1957). He stated:

> Time is an indispensable factor in learning. Therefore, the rate of presentation of information in relation to the comprehension rates of students is a fundamental consideration. The presentation-comprehension rates not only interact but these rates interact with other variables. Of these other variables the demands made on the learners by the number, complexity, and subjective difficulty of the materials are most important. Therefore, the pacing or determination of the rate of presentation of a body of information is a problem which must be solved for all instructional materials and methods.

These concepts should be considered by educators in the development of principles to guide instructional practices.

Patterson (1957) investigated the mental practice techniques in teaching college students how to thread and operate a Bell and Howell motion picture projector. One group received several showings of a film demonstration of threading a movie projector. Students were allowed to mentally practice the steps during and between showings,

but they never actually threaded a projector. A second group received three hours of individual laboratory instruction and practice on the projector. Results showed both groups to be equally proficient in threading the projector as measured by a performance test. However, the actual practice group took less time to perform this skill.

An application of the practice concept developed in these studies for shop, laboratory, or technical subjects cannot be overlooked by educators. Hoban (1960) stated:

> The participation techniques studied in film research are closely related to feedback information on performance. Educational research has long since established the effects of knowledge of results in learning. When knowledge of results is added to participation, or otherwise incorporated in the methodology of film use, an increment in learning is generally observable.

Educators involved in the training of technicians, scientists, and skilled workers cannot neglect these emerging intellectual tools and their effect upon the teaching of manipulative skills.

In a study of visual aids in dental training, Yock and Erlandson (1958) taught part of the porcelain jacket and crown techniques by three methods: film alone; demonstration alone; film and demonstration together. The combined film and demonstration method was significantly better than the film alone method, a fact which might possibly be explained by the very small groups of eight or nine who saw the demonstrations, in contrast to the customary large demonstration groups.

VanderMeer (1945) found that motion pictures, which can enlarge and slow action, are a superior way of demonstrating lathe operation. Students who saw a film demonstration learned faster than the group instructed orally by the teacher.

Stein (1959) reported conflicting findings in the use of film-loops for instruction in beginning typing at the high school level.

Results showed that the film-loop class typed more rapidly, but that the control class typed more accurately; both differences were significant. The question posed by this experiment is: which is the desired goal in the teaching of typing.

Learning from Instructional Television

One of the most comprehensive surveys on the effects of learning from instructional television was reported by Schramm. (1962) He presented the findings of 425 experiments with adequate design, controls, and statistical treatments. In 393 of these experiments instructional television was compared with various forms of classroom teaching.

Evidence presented in these studies revealed that individuals learned efficiently from instructional television. An analysis of data comparing instructional television and classroom teaching revealed that in 65 percent of the cases there was no measurable evidence of the superiority of one or the other method; that in 21 per cent of the cases students learned significantly more from instructional television; and in 14 percent of the cases significantly more was learned from classroom teaching.

Schramm's data presentation indicated that certain subject-matter areas were more appropriate to instructional television while others were taught more effectively by classroom teaching. He concluded that mathematics, science, and social studies were taught with a greater degree of effectiveness by instructional television than were history, the humanities, and literature. However, instructional television and classroom teaching produced about the same degree of effectiveness in health, language arts, and safety.

An interesting finding from this survey was that grade-level and subject-matter tended to influence the direction of significance. Schramm (1962) stated that:

> In several cases, there appear to be interactions of importance between subject matter and grade level. Televised language skills have been found to be somewhat less effective than have other televised subjects at the early elementary-school level, although still, on an over-all basis, as effective as classroom teaching. Mathematics has been more effectively taught by television in the early grades than in high school. Televised social studies has been somewhat less effective in college than in the lower grades, and the humanities group also appears to have been taught less effectively on television at the higher-grade levels.

The evidence presented in Schramm's survey, learning from instructional television, indicated a wide variation in the effectiveness of learning subject-matter with reference to grade-placement. The nature of the subject-matter and the grade-placement of subject-matter were important factors in the effectiveness of learning from instructional television.

A number of studies conducted at the elementary and secondary levels favored teaching by television. When such differences exist they usually can be explained by conditions other than the mere fact of television transmission. Studies such as the "Report of the National Experiment of Television Teaching in Large Classes," (1959) "Teaching by Television," (1959) and "Washington County Closed Circuit Educational Television Project" (1959-60) are examples of studies where television did not carry the entire teaching load, but was used to augment regular classroom instruction. Therefore, television may reach its fullest potential when used to supplement regular classroom teaching.

Macomber and Siegel (1957) investigated the novelty effect of television learning by students. Their findings indicated that students taught by television performed less effectively in comparison

with students taught by a conventional method in the second semester of a year-long sequence. There was no difference found in the achievement of students during the first semester. Kumata's (1958) study did not support these findings. He found that there was no difference in informational gain between students who had a prior course by television and those who were receiving this training for the first time. However, students with previous television experiences were significantly more favorable in their attitudes toward instruction by television.

Kanner (1960) conducted an interesting study regarding the intelligence levels of subjects and their ability to learn by television. He found that low-ability students learned more from television than from face-to-face instruction, while high-ability students learned more from face-to-face instruction. Studies by Klapper, (1958) and Pollack (1956) have produced mixed results about intelligence levels of subjects and their ability to learn. A plausible explanation for the differences is offered in the Cincinnati Study (1959) in which level of difficulty of subject-matter and instructor treatment are cited as possible determining factors. This study indicates the need for homogeneous ability-level grouping to prevent the loss of either high or low-ability students.

In a later study Kanner (1960) found "face to face" teaching to be superior to television in the immediate post-test situation. However, scores on retention tests, given a month later, revealed that the difference no longer existed. This study suggested that television-taught students retained proportionately more of what they had learned than conventionally taught students.

The "Bulletin on Higher Education" (1963) summarized an interesting study on the teaching of veterinary medicine. The School of Veterinary Medicine at Michigan State University found that television enhanced instruction in operative techniques. Operations on live animals and simultaneous surgery on cadavers, when alternately shown to large groups of students, resulted in greater medical dexterity for larger numbers in comparison with smaller numbers watching surgery at close hand. The same study revealed that diagraming procedures utilized with television presentations contributed to the superiority of learning by this media.

Learning from Variations in Instructional Media

One criticism of instruction through audio-visual media stems from its alleged reduction of "participation" and overt practice. Carpenter (1957) stated the following view on this criticism.

> The criticism springs from lack of systematic thought about the full range of actions inherently involved in learning and the reinforcement of learning which results from these actions. Seeing and hearing are activities. Complex perception is activity. Thinking is action. Using symbols, abstracting, deducing, generalizing, inferring, and concluding are all activities intimately involved in learning. Learning is activity, but all forms of activity are not learning. Furthermore, different kinds of activity affect and facilitate or inhibit learning in different degrees. Covert activity may be more or less effective than overt activity depending on the level of development of the individual and the requirements of the learning task.

The following investigations indicate the nature of some of the research which attempts to answer this criticism.

Murnin and associates (1954) investigated three methods of teaching principles of electricity to naval trainees. The three methods were: (1) lecture-demonstration; (2) "wiring board" method, which allowed subjects to practice exercises on a mock-up of an

electrical system; and (3) the "diagram" method, which permitted students to practice exercises on drawings of the wiring board. For purposes of evaluation subjects were administered a (written) test designed to inventory their ability to solve electrical circuit problems and their ability in practical application of electrical testing meters.

Results showed no significant differences among the three methods on overall learning. However, the meter sub-test showed the diagram and wiring board groups to be superior to the lecture-demonstration method groups in both schools. These findings indicated that the nature of the content may be a factor influencing the effects of practice.

Emerson and Wulff (1957) investigated a paired-associate learning task which required students to learn the names of eight electrical circuits. Eight of the circuits consisted of four pairs in which members of each pair were almost identical and, thus, highly confusable. Unstructured self-study was compared with a formalized paired associate learning procedure in which the circuit diagrams were presented one at a time and the learner selected the correct circuit from a list of the eight named. Results of the experiment indicated that both methods of training were relatively inefficient because of the difficult learning task. However, the learning was considerably more rapid under conditions of unstructured self-study than for the paired-associate method. These results, like those of Newman's, (1957) emphasized the necessity for analyzing a learning task and ensuring that appropriate practice and clues are provided in a formalized learning sequence. Any attempt to develop and apply a science of teaching without a consideration of these concepts is to negate the performance attained.

Galpersin (1957) found that watching another person perform, with close attention, produced better orientation to a task than the individual trying it from the outset.

Jones (1959) found that specially prepared study guides used by individual pupils had the same practical value as the usual types of teacher-directed activities.

Johnston (1956) used one hundred and six college students in a course in general electricity over a period of two years to determine the superiority of teacher demonstrations over shop activities. Results showed that experiences in constructing models did not enhance final achievement in the subject.

Swanson and Aukes (1957) utilized six different treatments to teach fuel, hydraulic, and rudder control systems to aircraft maintenance technicians. Treatments consisted of: (1) operating mock-up; (2) non-operating mock-up; (3) cut-away mock-up; (4) animated panels; (5) charts; and, (6) symbolic diagrams.

Results showed no significant difference among the devices when a lecture was presented with them. However, when the lecture was omitted, significant differences were found in immediate recall for the hydraulic and rudder control systems, but not for the fuel system.

Newman and Highland (1956) investigated the teaching of technical material to Air Force trainees. Several classes were taught a five-day coursein "Principles of Radio" by highly qualified instructors. A second group of classes were taught the same materials through the utilization of a tape recorder, and either a workbook or slides. In this experiment students taught by the tape-recorded lectures achieved levels of attainment similar to those of students taught by the instructors.

Summary

The teaching of manipulative activities by film, television, and programmed instruction was reported to be effective. It seems apparent from the studies reported that careful consideration must be given to the nature of the task to be learned. The learning of a certain task requires different types of observation and participation by the learner.

The most popular findings in the studies reported are that no significant differences were obtained among treatment comparisons. When significant differences were obtained, they seldom agreed with findings of other studies on the same problem.

Experimental evidence presented in this section indicates that learning takes place effectively under various kinds of instruction. Furthermore, in the area of visual display aids, the general indication from research is that picture and television have many advantages and applications in teaching manipulative skills. These methods of presenting information are considered in many studies for their relationship to learning theory. Developmental research is needed to bridge the gap between theory and practice.

Industry has found programmed instruction to be at least as effective as other methods of instruction. All the studies reported indicate that programmed learning results in less instructional time which to industry means a saving in man hours and money. This finding is important to those industries training individuals for any aspect of the world of work.

NEW INSTRUCTIONAL APPROACHES USED IN VOCATIONAL-TECHNICAL EDUCATION

Experimentation or research in public vocational-technical education in the area of instructional techniques and/or the learning process is limited in nature. Although the present study was limited to the machine trades and related areas, the investigator felt the need to explore in greater detail how educational media are being used to train individuals for the world of work. The following training programs are using some form of individualized instruction:

Adult Basic Education
Job Corps Centers (men's and women's)
Adult Education
Community Action Programs
Work-Experience Projects
Neighborhood Youth Corps
MDTA Programs
Vocational Education Programs
Technical Education Programs
Community College

The purpose of this section of the study is to describe in detail the nature of three of these programs and how they utilize individualized instruction in their training programs.

North Carolina's Fundamentals Learning Laboratories System (1965)

North Carolina has established nineteen "Learning Labs". Each is a part of the adult education services of an institution in the Community College System, and all but three are located in campus buildings.

Most students are enrolled in the "Learning Lab" to prepare themselves for the high school equivalency examination or to gain educational improvement or for remedial work.

The Fundamentals Learning Laboratories utilize a systems approach to provide the academic knowledge and skill needed or desired by an individual. It consists of an accumulation of commercially available materials, used under selected procedures and principles to make them maximally available to, and effective with, adults. The "Learning Lab" is organized so that any individual can attend at a time convenient to him, stay as long as he can, work at his own most efficient pace, use the instructional materials most effective with him, and study only the subjects and skills that serve his own particular purpose. The materials available in the center are as follows:

Reading:

TMI's First Steps in Reading
SRA's Kits Reading For Understanding (General and Junior).
IA, IIA, IIC, and IIIA
Craig's Programs C1, C2, C3, and B
Michigan Successive Discrimination Language Program

Arithmetic:

Temac'c: Basic Mathematics with Measurement
Seventh Grade Mathematics
Modern Mathematics for the Junior High School
Univox's: Arithmetic
Electronic Engineering's Arithmetic
California Test Bureau's Series E-F Mathematics
TMI's: Multiplication-Division
Decimals
Tutortext's Fractions
Graflex's: Addition of Like Fractions
Computing Square Root
Introduction to Probability

Language Arts:

Harcourt, Brace, & World's: English 2200
English 2600
McGraw Hill's 300 Commas
California Test Bureau's Series E-F Mechanics of English
TMI's Spelling
SRA's Words
Cenco's Vocabulary Building I and II

Social Studies:

Univox's: History of the United States
Geography of the United States
Behavioral Research Laboratories' Unites States Geography
Coronet's Maps - How to Read Them
McMillan's:How a Bill Becomes a Law
Ginn's:The Constitution
Cenco's:Great Themes in American History I and II

Sciences:

TMI's General Science Series:
Biology and Chemistry
Work and Machines
Measurement, Meteorology, and Astronomy
Sound, Light, Electricity, and Communications

Programmed Learning Center, Mahoning Valley Vocational School (1965-1966)

Ohio's Mahoning Valley Vocational School, located at the United States Air Base, Vienna, Ohio, is reported to be the only Manpower residential center of its kind in the United States. Under the Manpower Development and Training Act, the school is a federally funded, state chartered institution, operated by a non-profit organization. It's purpose is to train disadvantaged boys 16 through 21 who are out of school and out of work.

The Programmed Learning Center at the Mahoning Valley Vocational School was established in an attempt to fill certain voids in its educational programs. The center was an effort to assist the school in offering each individual a "customized educational program".

At Mahoning Valley programmed instruction is used in many ways. A few examples are as follows:

1. Students functioning on an educational level above remedial in math and reading may be channeled into the center.
2. Students may use it for taking courses aligned with their vocational areas.
3. Students may use the facilities of the center on their free time.
4. Vocational Instructors may send boys to take particular aligned courses during the day or evening.
5. Students may work to make up high school credits.

Programmed Learning Center Operation:

Students are referred to the PLC by their class instructor. For example, if a math instructor feels a particular student is functioning above the remedial level in class, this student may be sent to the PLC for advanced math. Some students that are sent to the center are given a complete choice as to the courses they will pursue. These are generally trainees functioning on a twelfth grade level or better in both reading-communication skills and math. Each student referred to the PLC is given an interview by a member of the center staff during which programmed learning is explained. During this orientation period all the available programmed materials are shown to the student. Emphasis is placed on pointing out to the student those materials that should benefit him most. He is allowed a certain degree of freedom in selecting materials within a range of course materials.

The student has been allowed to pursue, at leisure, non-vocationally oriented courses (such as Russian, French, Chess, etc.) if he is also willing to pursue a vocationally oriented course. After two years of operation this approach has proven very successful.

The center houses about two-hundred ninety-eight programs and can accommodate as many as fifty students working on different programs simultaneously. The following is a list of course and programmed materials available in each course. It is important to note that there is overlaping of programmed materials from one course to another. For example, Blue Print Reading may be used in two or more courses.

WELDERS

Blueprint Reading
Construction Measurement Skills
Math Measurement
Applied Electricity
Basic Math
English Grammar
First Aid
Verbal Problems In Algebra
Shop Math - Area & Volume
Safety
Shop Math - Powers of Ten
Field Sketching Practices
Reading Engineering Drawings II
How to Read Scales
Torch Cutting
Beginning Work with Equations
Visualization & Transfer
Basic Hand Tools
Venereal Disease

PRODUCTION MACHINE OPERATOR

Reading Engineering Drawings
Reading Engineering Drawings II
Construction Measurement Skills
English Grammar - Punctuation & Capital
Algebra I
Drills I - II
Gears - Spur Gear
Gears - Worm & Worm Gears
Gears - Installation
Gears - Bevel Gears
Caliper
Vernier Scale
Basic Math Measurement
Gas Welding
First Aid
Safety
Verbal Problems in Algebra
Slide Rule Operation
Mechanical Aptitudes & Spatial Relations Tests
Sheet Metal Layout
Shop Math - Algebra
Shop Math - Area & Volume
Shop Math - Powers of Ten
Chain Hoists
Valves & Their Functions
Reamers - Expansion etc.
Basic Machines
How to read Scales
Beginning Work with Equations
Basic Hand Tools
Venereal Disease

GENERAL OFFICE CLERKS

Effective Business Letters

Effective Letters

Business Math

Reading & Evaluating Financial Reports

English Grammar

Economics

Spelling Improvement

Basic Bookkeeping

Quick-rite Shorthand

Life Insurance

The Accounting Process

Safety

First Aid

Income Tax

Filing Skills

Vocabulary (office)

Cutting Office Costs Through Work Simplification

Payroll Record Keeping

Cash Register Operation

Principles of Accounting (Management Edition)

Improving Your Writing

How to Follow the Stock Market

How to Get Along With Your Bank Statement

Venereal Disease

PERIPHERAL MACHINE OPERATOR

Binary Math

Computer Math

Computer Programming

Algebra I

Business Math (Payroll)

Business Math (Acct. & Finance)

English Grammar

Collator

548 Interpreter

514 Reproducer

1620 Computer

1401 Computer

Introduction to Data Processing Systems

The Accounting Process

Advanced Computer Programming

Computers - Business & Scientific Application

Safety

First Aid

Filing Skills

Applied Logic

Venereal Disease

3M Data Processing

Fortran - Computer Language

CRAFTSMAN

Algebra I
Algebra II
Plane Geometry
Applied Trigonometry
Reading Engineering Drawings
Logarithms
Slide Rule Fundamentals
Mechanics
Verbal Problems in Algebra
Field Sketching
Visualization & Transfer
Applied Electricity
First Aid
Safety
Solid Geometry
Sections Drawings
Sheet Metal Layout
Beginning Work with Equations
Venereal Disease
Creativity

ELECTRICAL APPLIANCE REPAIR

First Aid
Safety
Basic Electricity
Elementary Electronics
Fundamentals of Electricity
Applied Electricity
Basic Electronics
Statics Electricity
Civil Service - Electrician
Electrical Language
Reading Engineering Drawings
Construction Measurements Skills
Shop Math - Algebra
Basic Transistors
Generation of Electricity
Beginning Work with Equations

Algebra I
Slide Rule Fundamentals
Using Electricity
Systematic Trouble Shooting for Refrigeration & Air Conditioning Systems
Basic Hand Tools
Venereal Disease
Logical Electrical Trouble Shooting

AUTO SERVICE CENTER & AUTO MECHANIC

First Aid
Safety
Business Math - Algebra
Shop Math - Area & Volume
Basic Engine Lubricants
Engine Component Concepts I - II
Electrical Language
Generation of Electricity
Torch Cutting
Engines
Oxyacetylene Welding
Civil Service Mechanic
Gears - Spur Gears
Gears - Gears Ratios
Gears - Installation
Gears - Worm & Worm Gears
Gears - Bevel Gears
Chain Hoists
Beginning Work with Equations
Basic Hand Tools
Venereal Disease
Principles of Hydraulic & Pumps
Basic Hydraulic Fuel Pumps

BUILDING MAINTENANCE

Reading Engineering Drawings
Construction Measurement Skills
Basic Math Measurement
Applied Electricity
English Grammar
Spelling
First Aid
Verbal Problems in Algebra
Shop Math - Area & Volume
Shop Math - Algebra
Safety
Basic Math
Field Sketching Practices
How to Read Scales
How to Measure Board Feet
Gas Welding
Torch Cutting
Civil Service - Carpenter
Basic Hand Tools
Tapes and Squares
Business Math - The Pay Check
Pipefitting
Venereal Disease

First Aid

Safety

Torch Cutting

Oxyacetylene Welding

How to Read Scales

Ratios & Proportions

AUTO BODY

Business Math - Payroll

Vocabulary Growth

Chain Hoists

Venereal Diseases

Basic Hydraulic Fuel Pumps

Principles of Hydraulics & Pumps

LANDSCAPES

First Aid

Safety

Field Sketching

Basic Math

Construction Measurement Skills

How to Read Scales

Venereal Diseases

An Integrated Experience Approach (Oakland Community College) (1967-1968)

Oakland Community College has established a unique "systems approach" or "integrated approach" to learning. Emphasis is placed on student learning rather than on the mechanisms of teaching. It requires that a major portion of the learner's time be spent in independent study and only a minimum amount of time spent in traditional group learning. The program requires the staff in a particular area to identify as clearly as possible those responses, attitudes, concepts, ideas, and manipulatory skills to be achieved by the student. The staff then designs a multi-faceted, multi-sensory approach which will allow the student to direct his own learning activities to attain these objectives.

The responsibility for learning is on the individual student as he maintains close personal contact with the instructor. The learning activities are organized in such a way that students can proceed at their own pace, filling in gaps in their background information and omitting the portion of the program which they have covered at some previous time. However, students must meet designated evaluation periods. The nature of this approach lends itself to the use of every type of educational media available and attempts to align the exposure to these learning experiences in a sequence which will be most effective and efficient. The kind, number and nature of the media involved depends on the nature of the subject under consideration.

This system differs from the written programmed instruction and the conventional lecture laboratory approach in several important ways:

> "1. Most subjects require that a student receive a variety of learning experiences to become properly informed about them. The conventional teaching system recognizes this requirement and attempts to fulfill it through the scheduling of lectures, laboratories, recitations, etc. In the integrated experience system, these activities can be organized in a stepwise fashion with a reduction in the disassociation in time and space encountered in the conventional approach, while at the same time the logical learning progression characteristic of written programmed instruction is retained. Further, the learning events need not be limited to the vicarious participation of the student through his reading only, as in written programs. Hour-long lectures of necessity cover several units of information. Some of these topics are covered more meaningfully when there is associated with them, student involvement through experimentation, observation, textbook reading and other appropriate activities. The limitations of time and physical facilities make this kind of integration unfeasible under the conventional system but are clearly practical under the integrated experience system utilizing audio tape programming.
>
> 2. In the audio-tutorial booth the voice of the instructor provides timely information, definitions and parenthetical expressions with minimal effort for the learner. These helpful aides are often omitted from a student's study because of the inconvenience involved in looking up words, and because such thoughts seldom fit well as a part of a written text. The tone of voice places emphasis on important points and expresses authority not sensed through reading the written word." (1964)

INSTRUCTIONAL MODEL - The instructional model is made up of three elements (assemblies, learning laboratories, and progress evaluations) maximizing three principles of learning (motivation, activity, and knowledge of results) and is designed to produce learners who will complete the specified requirements.

LEARNING LABORATORIES - Laboratories and faculty members are available to the student as he learns to follow the instructional sequence directed by the faculty. Maturity and independence must be exercised by the student in using these laboratories. There is

always the opportunity for close personal contact with the faculty and is a major feature of the approach.

LEARNING RESOURCES CENTERS - These provide resources and facilities to supplement the instructional program. Available are printed and audio-visual materials.

OBJECTIVES - 1. To provide the first two years of college parellel to the requirements of four-year institutions.

2. To provide post-high school vocational and technical training.

3. To provide community services meeting the educational, cultural, and recreational needs of the Community College District.

4. To provide general education for the development of a broadly educated person who is capable of thinking and communicating effectively, making relevant judgments, distinguishing among values, and making appropriate applications.

5. To provide opportunity for higher education for promising students with scholastic or subject deficiencies.

6. To assist students in self-evaluation and to direct them into their area of maximum potential thru counseling and guidance services.

PROGRAMS -

Transfer programs provide the first two years toward a bachelor's degree.

Associate of Arts Degree for students entering:

Education-elementary, secondary, special education
Engineering-chemical, civil, electrical, mechanical
Liberal Arts - economics, fine arts, law, political science, social sciences, etc.
Science- biological, mathematical, physical, and later pre-professional work

Associate in Business Administration Degree

Accounting
Business
Marketing

Career programs provide intensive study in specific occupational areas in preparation for immediate employment.

Agriculture- landscape technology
Business- accounting, data processing, executive secretarial, retailing, stenography
Food services- commercial cooking and baking, food service technology
Graphic arts- commercial art
Industrial- automotive, drafting, electronics, mechanical design, mechanical production, radio and television repair
Paramedical- dental assisting, medical laboratory technology, medical office assisting, nursing
Public service- law enforcement, library technology

Summary

The three programs presented in this section indicate an emerging trend in the instructional practices for vocational-technical education. Each program illustrates an interesting way in which instructional techniques can be organized to make learning more efficient and effective for the individual learner.

The "Learning Laboratories" approach used in North Carolina has implications for programs concerned with retraining and upgrading of individuals. Connecticut has had difficulties finding individuals with the basic educational background for many of its manpower programs. Many of these individuals could narrow this gap between their educational background and future occupational skill through a program similar to the "Learning Laboratories" program. The "Learning Laboratories" concept enables the individual to regulate or pace his rate of learning in the acquisition of new information and knowledge needed for proficiency in a particular subject or skill area. The program utilizes only commercially prepared materials that are related to academic areas and have limited relationship to the individual occupation.

The second program presented indicates how individualized instruction is integrated with conventional teaching methods. Mahoning Valley with its programmed learning center illustrates how individualized instruction can be utilized to supplement the related and shop areas. Because of the success of the programmed learning center, the school is establishing a reading and math center which will make extensive use of educational media in a variety of forms.

It is important for the reader to compare the programmed materials utilized in these two learning centers. Although the two programs are different, many of the same basic programmed materials

are used. This dual use of material indicates the flexibility of some programs, but more important it indicates the need for the development of specific programs for a particular training program.

The third program magnifies this problem and has established a unique system to meet their particular educational problems. Oakland Community College has developed an integrated program for each of its curricular areas. This approach requires the individualization of each course through the use of a variety of instructional media and a cooperative effort on the part of specialists in a particular subject area. The uniqueness of the Oakland program and importance to the present study is the cooperative planning that goes into developing materials for instructional purposes.

Of the three programs presented in this study Oakland Community College is the only one that has integrated commercially prepared materials with those developed by staff personnel. The greatest majority of materials used are staff prepared. It is a program that utilizes not only programmed instruction, but film loop, slides, tapes, books, models, and other types of instructional media to make learning more meaningful to the individual learner. Each program allows the learner to progress at his own rate, the only restriction being that students must meet evaluation requirements.

The success of these programs and a comparison of the same type of programs within our own state indicates the need for establishing a cooperative program between the University of Connecticut, Central Connecticut College, the Division of Vocational and Technical Education (State Department), Vocational-technical schools, and technical colleges.

The reader should also note the fact that in the three examples presented, none of the programs have developed any materials that enhance the teaching of manipulative or shop skills. Most of the programs only present materials in the related areas. However, some of the studies in section one indicated the success of training military personnel in shop skills.

There is no statistical information on the success of these three programs. Justification for each program is based upon the success of individuals in their selected field of endeavor. The investigator feels that the key to success in these three programs is leadership and teaching staffs that are dedicated to improving instructional techniques to meet the needs of the individual learner.

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The primary purpose of this study was to ascertain to what degree educational media was being used in vocational-technical education. Special emphasis was given to the machine trades and related areas, but because of the dearth of material in this particular subject area the study was expanded to include other trades and industrial subjects, and their related areas.

The study includes a review of the related literature, a survey of state programs, visitations to a limited number of unusual programs, and examination of educational media utilized in vocational-technical education. Information about the utilization of educational media was also reviewed from the four vocational research centers.

Conclusions:

In terms of the material collected and reviewed for this study the following conclusions were inferred:

1. Programmed instruction when used by industry and/or the military is at least as effective as other instructional methods.

2. Programmed instruction when used by the military or industry cuts training time 20 to 30 per cent and does not affect the amount learned or retained.

3. Individuals from all ability and age levels can learn effectively from properly prepared programmed materials. Economic or educational background does not affect or limit the use of programmed materials.

4. The amount and type of educational media available for use in vocational-technical education is limited. The quality and utilization of this material in many vocational-technical schools is spotty at best.

5. The State of Connecticut has developed some excellent materials for use in its vocational-technical schools. However, little emphasis has been placed on developing and evaluating an integrated or systems approach similiar to the one established at Oakland Community College. In addition there is no known vocational-technical school in Connecticut that has in operation or in the planning stages a programmed learning center like the one at Mahoning Valley Vocational-Technical School.

6. Only limited effort has been made to integrate educational media into the teaching of the manipulative skills required in a particular shop area.

7. The State Department, University of Connecticut, and Central Connecticut State at the present time do not have the staff, faculties, equipment, and instructional materials available to train and assist teachers in the development of an integrated or systems approach to teaching shop skills and related areas.

8. Other than the limited work done by the military, no effort has been made to develop an integrated or systems approach to the teaching of manipulative skills required in a particular shop area, for example the rebuilding of a fuel pump. This is usually accomplished by a lecture-demonstration by the instructor

Recommendations:

1. That the Division of vocational-technical education, State Department of Education in cooperation with the School of Education, University of Connecticut should establish an instructional materials resource center.

The concept of such a center is related to the complex problems facing educators as a result of population and knowledge explosions. These problems have sent the educators searching for more effective and efficient instructional strategies. The proposed center would serve to develop and test instruction systems involving faculty-centered instructional activities and student-centered learning activities for vocational-technical education. Based on the needs it is designed to meet, such a center would have to be more than a simple depository for instructional materials. It should at a minimum, have the capacity to:

(1) create and test new instructional strategies

(2) field test the instructional materials and systems it distributes

(3) develop systematic programs in the facilitation of local production of instructional materials

(4) offer credit and non-credit instruction in the acquisition, design, and testing of educational systems.

The proposed center would be established within the context of the programs in vocationa-technical education sponsored by the State Department, Central Connecticut State, and the University of Connecticut. Such a center would have the following advantages:

A. A center directly affiliated with a graduate research program in education is in a unique position to assess the efficiency of the materials it distributes and design and test material of its own.

B. A center directly associated with all the teacher preparation programs in vocational-technical education could incorporate all the areas of specialization at the undergraduate and graduate levels into the development and testing of educational media.

C. A center developed with the cooperation of the State Department of Education could insure direct access to the State's vocational-technical schools for field testing new materials and systems.

D. A center developed within the university structure in cooperation with the State Department has optional staff, flexibility, and can justify, with greater ease than any other state unit, expenditures for training programs, research, and advisory and consultive functions. For example: the center could utilize the staff and faculties of the instructional material, developmental laboratory, and the audio-visual center. To establish such a center would require funds for staff, equipment, and materials.

2. That the proposed center be established as an arm of the Department of Higher, Technical, and Adult Education, University of Connecticut, assuring it the capacity to adapt, create, and assess materials and methods for the training of individuals for the world of work. Its consultant staff should include members of the State Department of Education, Division of Vocational-Technical Education, insuring inter-state agency cooperation and laying the foundation for the vital rapport between the center and its field clients.

3. That the instructional materials developed or procured should be tested under operational conditions by a team of experts in the subject area being investigated. The team should include

individuals from the State Department, University of Connecticut, Central Connecticut State, and vocational-technical schools. Such evaluation would require the designing of research to assist in answering the questions related to the effectiveness of various instructional approaches. This study would be an important function of the advance graduate study of students majoring in the various aspects of vocational-technical education.

4. That the staff of the instructional materials resource center should cooperate with the instructors of the various subject areas in determining the kind of materials needed, revise existing materials, produce new materials, and edit teacher produced materials. Instructors from the various subject fields should be given time during the school year and summer to work with the staff of the center in developing materials.
5. That the vocational technical schools located in Manchester, Willimantic, and Hartford should be utilized as experimental centers for the testing of instructional materials developed by the instructional materials resource center.
6. That the instructional materials resource center's staff cooperate with similiar centers throughout the country to minimize the duplication of effort and also to keep abreast of new instructional materials and methods being utilized in vocational-technical education.
7. That because the University of Connecticut is the only University in New England with a sixth year and doctoral program in industrial education that the instructional resource center could become a regional center coordinating the other New England States.

8. That the instructional materials resource center should start in the fall of 1967 and limit its operation to the development of materials in one subject area (automotives, electricity, etc.). The new center should also concentrate on developing materials related to the teaching of manipulative skills required in the selected shop area. The first effort could be patterned after the automated equipment laboratory used by the School of Education, University of Connecticut to teach students how to operate audio-visual equipment.

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